

Ensuring the Availability of Critical Raw Materials: A Strategic Priority for EU and Finland

Achieving climate goals and developing technologies require large quantities of mineral resources and metals. Critical raw materials are needed in, for example, the realisation of renewable energy, digital industry, and space and health technology. Up-to-date geological research on mineral deposits and value chains is of critical importance, enabling clean transition and securing the responsible supply of materials.

Economic resilience and technological advancement – based on geoscientific expertise

The availability of critical raw materials (CRMs) underpins Finland's economic resilience and technological advancement. To maintain leadership in critical raw materials research, it is vital to

- **improve exploration potential,**
- **deepen the understanding of Finland's mineral systems, and**
- **secure high-quality geodata.**

Collaboration with international partners and the private sector is key to overcoming current challenges. By focusing on these strategic areas, Finland can ensure a stable supply of CRMs, align with EU priorities, and support its long-term economic goals and responsible mining.

What are critical and strategic raw materials?

Different actors, e.g. EU and NATO, have their own lists of critical and/or strategic raw materials. The EU has identified critical raw materials that are of high economic importance to Europe and carry a high risk of supply disruption. The regulation names a total of 34 critical raw materials, of which 17 are also strategic. Strategic raw materials are essential for the green transition, digitalisation, and defence industry needs.

A material may not be critical now but may become one in the future. It is therefore vital to archive the data from exploration for future needs.

[For more, go to website](#)

GTK research presented in this Policy Brief contributes to these United Nations Sustainable Development Goals



CRITICAL RAW MATERIALS FOR THE EUROPEAN UNION

Primary commodity

- Antimony (Sb)
- Beryllium (Be)
- Phosphate (PO₄)
- Graphite (C)
- Cobalt (Co)
- Copper (Cu)
- Lithium (Li)
- Feldspar
- Nickel (Ni)
- Niobium (Nb)
- Platinum, palladium (Pt, Pd)
- Rare Earth Element, REE
- Scandium (Sc)
- Titanium (Ti)
- Vanadium (V)
- Tungsten (W)

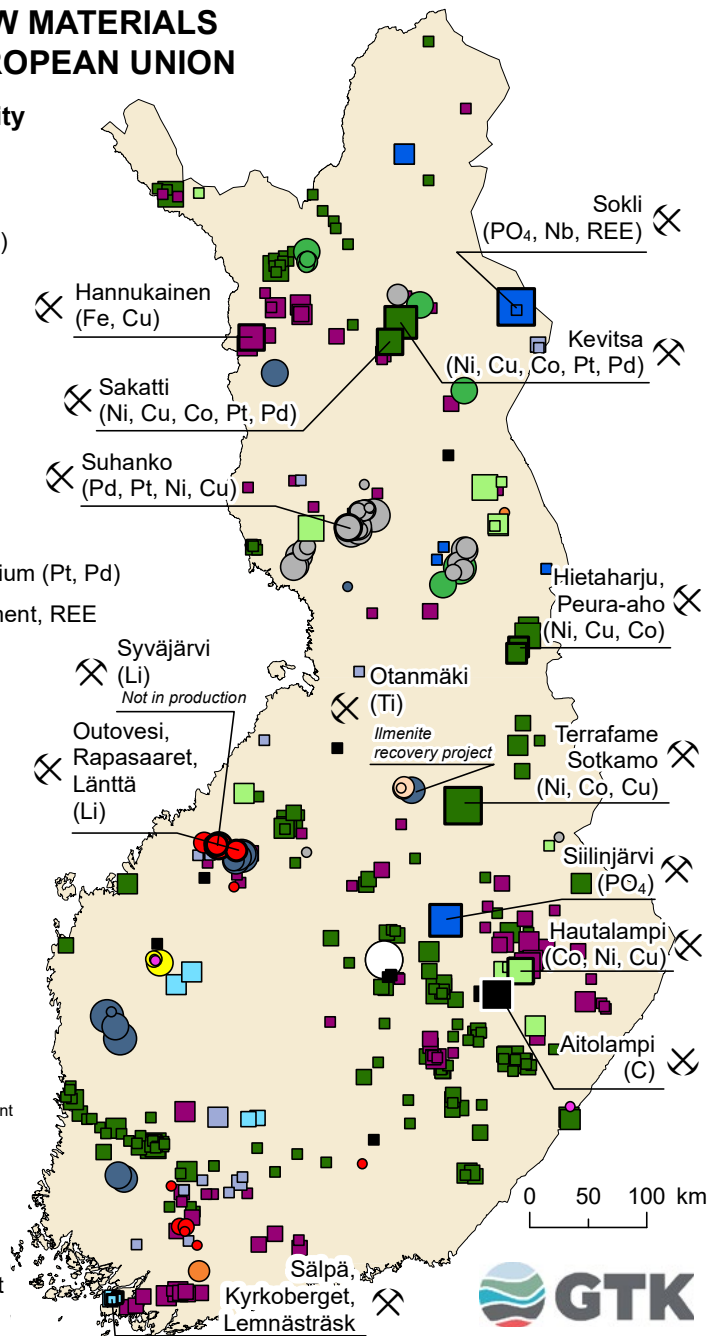
Size*

- Very large
- Large
- Medium
- Small
- Very small
- Unknown

*Remaining + extracted amount of the commodity

- ✂ Mine
- ✂ Mine project
- ✂ Advanced exploration project

6.3.2024



What is the difference between resource and reserve?

Mineral resources are a concentration or occurrence of minerals in or on Earth's crust, in such form, grade, or quality/quantity that there are reasonable prospects for eventual economic extraction. Mineral resources are the estimated amount of minerals in a deposit as based on the projections of geological evidence and knowledge at a given point in time, gathered from drilling results, sampling, geological modelling, and other methods.

Mineral reserves – also known as ore reserves – are a smaller subset of mineral resources deemed economically viable for extraction. The economic viability of extracting these minerals depends on market prices, extraction costs, and technological developments in metallurgy and processing. The part of mineral resources which become mineral reserves depends on factors such as location, quantity, grade, and geological characteristics of the mineral deposit.

The strategic role of critical raw materials in Finland's future

Critical raw materials (CRMs), which include e.g. rare earth elements, lithium, nickel, cobalt, are crucial for the production of batteries, magnets, and other high-tech components essential for the green transition.

The European Union has identified the secure and sustainable supply of CRMs as a critical issue for the continent's economic and strategic autonomy. The EU's Critical Raw Materials Act aims to reduce dependence on external suppliers, many of whom are in politically unstable regions, and to ensure that Europe can meet its own material needs. For Finland, this presents both an opportunity and a challenge: to not only contribute to the EU's goals but to also strengthen its own strategic position, by leveraging its mineral resources.

Finland's unique geological setting within the Fennoscandian Shield offers significant potential for the discovery and exploitation of CRMs. Our bedrock is rich in a variety of critical minerals, making Finland an important player in the global supply chain. The increasing global demand for CRMs, coupled with geopolitical risks and the EU's strategic push towards self-sufficiency in raw materials, underscores the need for enhanced exploration and resource management within Finland.

To effectively participate in the European and global initiatives, more accurate mapping of critical mineral deposits and improved resource management are required. GTK contributes to solving these challenges by

- **Deepening our scientific understanding of Finland's mineral systems.**
- **Developing more efficient and precise exploration technologies.**
- **Ensuring that our data acquisition, processing, and management are at the forefront of global standards.**
- **Improving processing solutions, enhancing the recyclability of materials, and promoting design-driven circularity in mining projects. (See individual policy brief on circular economy of minerals.)**

The strategic importance of CRMs for Finland extends beyond mere economic interest; it is also about securing the nation's role in the global transition to sustainable technologies and maintaining its competitive edge within the EU framework. Understanding and managing these resources through advanced scientific methods is important for Finland's future.

The European Union's Critical Raw Materials Act (CRMA)

- Entered into force May 2024.
- Aims to ensure the supply of critical (CRM) and strategic (SRM) raw materials.
- Focuses on sustainability and circular economy.

Main points

- Increase EU's capacity to extract, from its current 3% level, the ores, minerals or concentrates to 10% of annual SRMs used in the union from within the union.
- Increase EU's processing capacity, including all intermediate processing steps, to make it capable of producing at least 40% of the Union's annual consumption of strategic raw materials.
- Union recycling capacity, including all intermediate recycling steps, is capable of producing at least 25% of the Union's annual consumption of strategic raw materials and can recycle significantly increasing amounts of each strategic raw material from waste.
- No third country accounts for more than 65% of the Union's annual consumption of such a strategic raw material.

A national exploration programme

CRMA also includes the request for each member state to draw up a national exploration programme targeted at critical raw materials. The programmes aim at increasing available information on EU's critical raw materials and carrier minerals of the critical raw materials. The programmes should include the following measures:

- Mapping of critical minerals at a suitable scale.
- Geochemical campaigns, including the establishment of the chemical compositions of soils, sediments or rocks.
- Geoscientific surveys, such as geophysical surveys.
- Processing the data gathered in accordance with the above-mentioned methods and general exploration in predictive maps.
- Reprocessing of existing geoscientific survey data to check unidentified mineral occurrences containing critical raw materials and carrier minerals for critical raw materials.

[For more, go to website](#)

Current challenges in securing critical raw materials

Finland is currently producing (mining, processing, and/or refining) a number of critical raw materials (CRMs) and is the sole producer of cobalt in European Union. Furthermore, there are advanced mining projects that aim to start production of CRMs, including lithium, nickel, copper, cobalt, platinum, palladium, phosphate rock, niobium, and rare earth metals.

Despite this, Finland and the European Union are facing significant challenges in securing a sustainable supply of CRMs. The current production levels do not cover the goals set by EU's critical raw materials act for primary production.

The goals for obtaining CRMs from secondary raw materials and recycling are also challenging to reach. Recycling and existing secondary raw materials cannot cover the current needs either because the amount of CRMs needed exceeds the amount available via recycling or, in some cases, there are no significant amounts of secondary CRMs to be recycled. New CRM deposits must be discovered. The challenges of discovering new CRM deposits include:

- **A deep scientific understanding of various aspects of geological processes that have led to the formation of different kinds of CRM-bearing mineral deposits,**
- **The need for extensive and high-quality geodatasets (geological, geophysical, and geochemical)**
- **Capability and know-how to be able to process and integrate available geodata and geological knowledge into predictive maps for CRM deposits.**
- **The need for advanced exploration techniques such as, e.g. new surveying and sampling methods as well as data processing and integration methods, including the application of deep learning and AI.**

Scientific challenges include the need for improved geophysical and geochemical methods and the integration of new data with existing geological models to accurately assess resources and their potential location. Furthermore, the understanding of geological evolution and the bedrock of Finland beyond the current bedrock surface needs to be strengthened, in addition to an understanding of the formation of less well-known CRM-bearing deposit types.

At the EU level, the Critical Raw Materials Act aims to reduce dependence on non-EU sources and boost domestic production. However, achieving these goals demands significant scientific advancements and stronger collaboration among member states.

Finland plays a crucial role in this effort by addressing current exploration challenges and contributing to the EU's strategic autonomy in raw materials.

There are bottlenecks in the mineral and metal supply chain

A peer-reviewed study published in November 2024 highlights the massive scale of the challenge in phasing out fossil fuels. The calculations are showing the scale of the task, not predicting the future.

The research presents the physical requirements in terms of required non-fossil fuel industrial capacity, to completely phase out fossil fuels, and maintain the existing industrial ecosystem.

It shows that if we want to fully replace fossil fuels and maintain current industrial systems, the demand for minerals and metals – both mined and recycled – increases significantly.

The general plan to phase out fossil fuels focuses on replacing all fossil fuel-based vehicles with Electric Vehicle Technology (EVT) and hydrogen fuel cell vehicles, while phasing out coal- and gas-fired electrical power generation. The research points out some of the challenges in this plan, for example, unrealistic schedule, smaller capacity of the replacing energy systems and lack of known global mineral reserves.

[For more, go to website](#)

Strategic imperatives for strengthening Finland's CRM supply

Geological potential of Finland. The Fennoscandian Shield is rich in a variety of minerals essential for modern technologies. Finland has significant geological potential for critical raw materials (CRMs) and is currently a producer of nickel, copper, cobalt, platinum, palladium, feldspar, and phosphate rock. Understanding CRM-related mineral systems is crucial for identifying new exploration opportunities as well as ensuring a stable supply of these materials.

Advances in exploration techniques. Research has demonstrated the effectiveness of advanced geophysical and geochemical methods in enhancing mineral exploration. These techniques, when integrated with updated geological models, have improved the accuracy of resource identification, thereby reducing the uncertainty and risk associated with exploration activities and have limited the environmental footprint required by exploration activities.

Data quality and integration. High-quality geodata is essential for successful mineral exploration. GTK's efforts in collecting, processing, and integrating geological, geophysical, and geochemical data have significantly contributed to more precise mapping of potential CRM deposits. These data-driven approaches are

vital for informing decision-making and guiding future exploration efforts.

Strategic importance of collaboration. The research underscores the importance of collaboration both within Finland and across the EU. By working together with European partners, Finland can leverage shared expertise, access cutting-edge technologies, and align with the EU's Critical Raw Materials Act. Such collaborations are crucial for strengthening the EU's overall supply chain resilience.

Economic and environmental considerations.

The research also emphasises the need for balancing economic growth with environmental sustainability. Effective resource management, driven by robust scientific research, can help ensure that the extraction and use of CRMs contribute to sustainable development goals. This includes minimising environmental impact and enhancing recycling efforts.

These key insights provide the foundation for the recommendations outlined in the subsequent section, guiding Finland's strategic approach to securing critical raw materials for the future.

Key actions to secure Finland's critical raw materials

Strengthen Finland's position in the EU. Advocate for policies within the EU that prioritise the secure supply of critical raw materials. This includes active participation in the implementation of the EU's Critical Raw Materials Act and alignment with broader European strategies.

Enhance national exploration initiatives. Increase investment in mineral exploration across Finland, focusing on areas with high potential for critical raw materials. Secure a steady supply of geodata as well as utilise advanced geodata collection and processing methods to identify new deposits and expand existing ones.

Promote international collaboration. Build and strengthen partnerships with other EU countries and international organisations in order to share knowledge, technology, and best practices in CRM exploration and processing. This collaboration will enhance resource security and drive innovation.

Diversify supply chains. Develop strategies to reduce dependence on single sources of critical raw materials by diversifying supply chains both within Finland and across Europe. Encourage the development of responsible mining practices and the recycling of critical materials.

Increase public and industrial awareness. Launch initiatives to raise awareness about the importance of critical raw materials for economic stability and technological advancement. Engage with industries and the public to build support for policies and actions that ensure a stable supply of these resources.

Secure sustainable funding. Advocate for increased EU and national funding dedicated to CRM-related projects, including exploration, research, and innovation. Leverage opportunities within EU funding programmes such as Horizon Europe and Just Transition Fund to support these initiatives.

Sources and additional information

GTK's research areas, policy briefs and research projects

Availability of Critical Raw Materials – information and research projects

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GTK research news

- [New Visualisation of the Metals and Minerals Value Chain Emphasises the Side Streams and Their Value](#)
- [Research Project is Developing Deeper Critical Raw Material Exploration](#)
- [The Currently Known Deposits and Occurrences of Critical Raw Materials in Europe are Published as a Map](#)
- [The Battery Mineral Project Produced New Knowledge About Critical Raw Material Potential in Finland](#)
- [Official Bridging Document Creates a Connection Between UNFC Classification and CRIRSCO](#)
- [The European Classification of Mineral Raw Materials in Line with the Sustainable Development Goals Is Proceeding – The Geological Survey of Finland Participated in the Preparation of UNFC Guidance Europe](#)

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